REMARKS/ARGUMENTS

Claims 1-24 and 28-30 are pending. Claims 1, 10-14, 16, 17, and 22 have been amended. Claims 6 and 25-27 have been canceled. Claims 28-30 have been added.

Figs. 1-3 were objected for not designating them with -- Prior Art --. Applicants respectfully submit that Figs. 1-3 were presented being related to conventional devices, as Applicants understood them. Conventional devices are not necessary prior art. The figures were also prepared by Applicants independently and were not copied from a prior art reference. Accordingly, Applicants believe Figs. 1-3 should not be designated with -- Prior Art --. If the Examiner disagrees, Applicants respectfully ask the Examiner to provide an anticipating prior art reference.

Claims 19 and 22 were rejected under 35 U.S.C. § 112. These claims have been amended in response to the rejection.

Claims 1, 2, and 8-18 were rejected under 35 U.S.C. § 102(b) as being anticipated by Hshieh '128. Applicants respectfully traverse the rejection.

Claim 1 recites, "...a gate provided between the first and second source regions, the gate including a first portion extending laterally within the trench, wherein a depth of the trench is no more than a depth of the first doped region, wherein the gate has a lateral extension and a vertical extension, the lateral extension being substantially greater than the vertical extension to reduce the curvature of equi-potential lines that are defined below the gate and the first and second dope regions."

The claimed embodiment is directed to increasing the breakdown voltage (BV) of a power device. One way to achieve this result is by reducing the slope or curvature of equi-potential lines defined within the power device (see paragraph 34). This is obtained by providing the first portion of the gate within a trench and reducing the profile difference between the gate and the first and second doped regions. This reduces the curvature of the eqi-potential lines 288 and 298 (Figs. 4 and 5), thereby reducing the electric field in the vicinity of the p/n junction which increases the breakdown voltage (see paragraph 40). The claimed embodiment provides relatively flatter equi-potential lines since the lower portion of the gate is brought closer to the

lower portion of the P-well 286, so that together they would present a more evenly-shaped lower surface (compare with the lower surfaces of the devices illustrated in Figs. 1-3 of the present application).

In comparison, Hshieh '128 discloses in Fig. 1 a gate 22 that is substantially vertical in nature, so that the vertical extension is substantially greater than the lateral extension. In addition, the sharply protruding P+ region in the middle of P region 16 increases the curvatures of the equi-potential lines when compared to those of Figs. 2 and 3 in Hshieh '128. Accordingly, Hshieh '128 does not disclose "...the lateral extension being substantially greater than the vertical extension to reduce the curvature of equi-potential lines that are defined below the gate and the first and second dope regions," as recited in claim 1.

Moreover, claim 1 recites a gate that is relatively planar in shape, which can be made more easily and quickly and with less use of gate material than a vertical gate of Hshieh '128. For such a vertical gate, its deep trench would need to be filled to form it, so that a thick layer of gate material would be deposited over the entire wafer. Claim 1 is allowable at least for the reasons set forth above.

Claim 16 recites, "a gate provided adjacent the first source region, the gate including a first portion provided within the trench, wherein a depth of the trench is no more than a depth of the first doped region, the gate having a lateral extension and a vertical extension, wherein the lateral extension of the gate is substantially greater than the vertical extension of the gate." Hshieh '128 does not disclose the above recited features. Claim 16 is allowable.

Claims 19 and 22 were rejected under 35 U.S.C. § 102(b) as being anticipated by Hshieh '543. Applicants respectfully traverse the rejection.

Claim 19 recites "a gate provided adjacent the source region, the gate including a first portion provided within the trench and a second portion provide outside of the trench, the first portion having a length that is greater than the first depth of the trench, wherein the first portion includes a lateral extension and that is parallel to the first and second surface of the substrate, wherein the lateral extension of the first portion is at least 2.5 times greater than the first depth of the trench." Hshieh '543 does not disclose the features recited above. Claim 19 is allowable.

Claim 22 recites, "forming a gate structure provided adjacent the source region, the gate structure including a first portion provided within the shallow trench and a second portion provide outside of the trench, wherein the first portion includes a lateral extension and that is parallel to the first and second surface of the substrate, wherein the lateral extension of the first portion is at least 2.5 times greater than the first depth of the shallow trench." Hshieh '543 does not disclose the above recited features. Claim 22 is allowable.

Claims 3 and 4 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hshieh '128 in view of Taekeuchi. Applicants respectfully traverse the rejection. Claims 3 and 4 depend from claim 1 and are allowable at least for this reason.

Claims 5-7 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hshieh '128 in view of Hshieh '543. Applicants respectfully traverse the rejection. Claims 5 and 7 depend from claim 1. Claim 6 has been canceled.

Claims 20 and 21 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hshieh '543 in view of Hshieh '128. Applicants respectfully traverse the rejection. Claims 20 and 21 depend from claim 19 and are allowable at least for this reason.

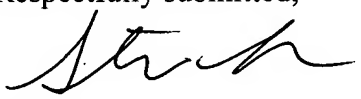
Applicants thank the Examiner for indicating that claims 23 and 24 include allowable subject matters.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,



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